service manual 22

marantz

model twenty two

Stereo Receiver

marantz

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INTRODUCTION

This service manual was prepared for use by Authorized Warranty Stations and contains service data for the Marantz Model 22 Stereophonic Receiver.

Servicing information and voltage data included in this manual are intended for use by the knowledgeable and experienced technician only. All instructions should be read carefully. No attempt should be made to proceed without a good understanding of the operation of the Receiver. A brief functional description and associated block diagram, furnished in the Operating Instruction Manual for the Model 22 Receiver, provides functional data about the Receiver as an aid in this understanding.

The parts list furnishes information by which replacement parts may be ordered from the Marantz Company. A description is included for parts which can be usually be obtained through local suppliers.

1. SERVICE NOTES

As can be seen from the circuit diagram the chassis of the Model 22 consists of the following units. Each unit mounted on a printed circuit board is described within the square enclosed by a bold dotted line on the circuit diagram.

1. FM Front End Unit ..... mounted on PC board, P100
2. AM Front End Unit ..... mounted on PC board, P200
3. AM IF Amplifier, FM IF Amplifier, FM MPX Stereo Demodulator, and FM Sub-IF Amplifier ..... All are mounted on PC board, P500
4. Auxiliary Audio Amplifier for FM tuner output, and FM Center tuning Meter Amplifier ..... mounted on PC board, P700
5. Tone Amplifier ..... mounted on PC board, P400
6. PHONO Amplifier ..... mounted on PC board, P300
7. Main Amplifier ..... mounted on PC board, P600
8. High and Low Filter Unit ..... mounted on PC board, P900
9. Regulated Power Supply Unit ..... mounted on PC board, P800
10. Protector Relay Driving Unit ..... mounted on PC board, P980

2. AM TUNER

2.1 Circuit Description

The AM tuner consists of two units, front end and IF amplifier unit mounted on a part of PC board P500.

The front end mounted on a PC board P200 is comprised of an RF amplifier, converter and a diode. The AM signals induced in a ferrite bar antenna are applied to base of the RF amplifier transistor H201 through a capacitor C201 and amplified to the level required for overcoming the converter noise, thus assures good SN performance. The tuned circuits

inserted in out- and input circuit of the RF amplifier gives very high image and spurious rejection performance. Thus amplified and selected signals are applied to the base of converter transistor H202 through a coupling capacitor C206. While the local oscillator voltage is injected to the emitter of H202 through capacitor C207. Both the signals are then mixed at base-emitter junction and converted into 455KHz intermediate frequency. The amplified IF signals obtained from the collector of H202 is applied to the first IF transformer L203.

The diode H203, reverse-biased by resistor R208 and R209, eliminates signal overload distortion without sacrificing any receiving sensitivity.

The IF signal output is led to the IF amplifier consisting of two stages (H510 and H511) through the pin J206 and J504, and amplified to the high level. The amplified IF output is applied to the diode H520 to detect audio signal. Then the detected audio signal is led to the output pin J515 through filtering network. The DC component of the detected IF signals is used as AGC voltage to control emitter current of H510 and RF amplifier transistor H201. A part of IF signal output is also applied to diode H521 through capacitor C562 and rectified to obtain DC current for energizing the signal strength meter M001.

2.2 Suggestion for Trouble Shooting of AM Tuner

Symptom: No AM Reception

First try to tune stations by rotating fly-wheel tuning knob slowly and observe the AM signal strength meter whether it deflects or not. If the signal strength meter gives a deflection at several frequency received, no failure exists in the stages at least preceeding IF transformer L511. Next connect an oscilloscope to the tuner output pin J515 and check audio signal. If the signal strength meter does not deflect, check the local oscillator circuit. Normal oscillator voltage at hot end of the oscillator capacitor is 2 to 3 volts, varying with tuning capacitor position. When measuring oscillator voltage use an RF VTVM, no circuit tester gives correct indication. If the local oscillator voltage is normal, check all voltage distribution in the tuner circuit by using a circuit tester and compare the measured values with those written in the schematic diagram.

3. FM TUNER

3.1 Circuit Description

The FM tuner section consists of three printed circuit boards, FM front end unit, IF amplifier / MPX stereo decording unit, and DC meter amplifier / FM audio amplifier unit.

FM signals induced by an FM antenna are led to FM antenna coil L101 through an attenuator switch and a BALUN coil. These signals are then applied to FET RF amplifier, the amplified output is applied to FET Mixer H102 through two tuned circuit and converted into 10.7MHz IF signals. H103 is the local oscillator transistor. The AGC voltage, obtained by rectifying a part of first IF output, is applied to the gate of FET H101

through the network R110, R111 and R101. The converted IF signals are led to the input pin J501 of IF amplifier unit consisting of three ICs (H501, H502 and H503) and two ceramic filters having sharp cut off characteristics. The IF signals fully amplified is then applied to the FM discriminator transformer L507 and demodulated into audible signals. The demodulated signals are then applied to the base of composite amplifier transistor H509 to obtain enough output power necessary to drive the stereo decording circuit packaged in IC H505. The amplified output is applied to the input pin 3 of the IC. Thus L and R channel stereophonic audio signals obtained are led to the FM audio amplifier mounted on a half of PC board P700.

The DC current caused at the point E in the FM discriminator circuit is used as a direct current source for driving the FM center tuning meter M002. First the direct current is led to the base of differencial amplifier transistor H701 through R514 and antenna tuning switch S002. The amplified DC output obtained from the emitter of H703 is led to the center tuning meter. R704 is the trimming resistor for null adjustment of the meter.

The stereo decording IC H505 is also equipped with an audio muting circuit and an automatic stereo-monophonic, switching circuit. Activating signals required for these circuits are obtained from the FM sub-IF amplifier unit consisting of two transistors H506 and H507. The amplifier unit obtains its input signal from the second FM IF amplifier stage through a small coupling capacitor C511 and amplifies it. The amplified output is then applied to the diode H517 and H518 and rectified into direct current. A part of the DC current is supplied to the signal strength meter M001 through resistor R539 and rotary switch S001-3R. The other part is applied to the DC amplifier consisting of H508 and H509, and its output is then fed to the muting control pin of IC H505 through the muting switch S003-1 and resistor R518. R004 is a muting level control variable resistor. Stereo-monophonic, automatic switching signal is also obtained from the rectified circuit and applied to the pin 4 of IC H505 through a resistor R565, R021, Diode H516 and H515.

The model 22 is equipped with a multipath antenna tuning system for the best FM reception. The simple principle of the tuning is given as follows. An FM antenna not correctly positioned toward an FM station induces some kind of distortion in FM signals. Thus deteriorating tonal quality of the programs. To reduce this distortion a suitable antenna direction must be found. For this purpose, the multipath antenna tuning system is employed.

The FM signals converted into 10.7MHz is applied to the sub-IF amplifier, the amplified output is then rectified by the diodes H517 and H518 as stated above. The rectified output is not true direct current but includes many amplitude modulated components caused by unsuitable FM antenna direction. These amplitude modulated components are separated by again detecting the rectified output by the diode H159 and led to the antenna tuning (FM center tuning) meter M002 through antenna tuning switch S002. The greater the deflection of the antenna tuning meter, the greater

the distortion of signal.

3.2 Suggestions for Trouble Shooting of FM Tuner

3.2.1 Symptom: No FM Reception

First turn on the power switch and try to tune FM stations. Rotate the fly wheel tuning knob slowly and observe the FM signal strength meter and FM center tuning meter. If the center tuning meter deflects at several frequency, the tuner circuits preceeding the discriminator circuit may have no failure. When the signal strength meter deflects but no deflection is obtained in the center tuning meter, there may be some defects between final FM IF amplifier H503 and the discriminator circuit. When no reading are obtained in both meters, check the local oscillator circuit by using an RF VTVM. Normal local oscillator voltage is about, 1 to 2 volts at hot end of the tank circuit. If the oscillator voltage is normal, check all the voltage distributions and compare them with those shown in the schematic diagram. When both meters deflect but no FM station is obtained check the following points by using a high sensitive oscilloscope; collector of composite amplifier transistor. Multiplex stereo output pin J507 or J508 and FM audio output terminal J711 or J713.

3.2.2 Sympton: No Stereo Separation

First check the MONO (L.R.) switches are in normal "out" position. Connect FM RF signal output modulated by stereo signal to the rear FM antenna terminals and check the stereo beacon lamp is turned on or not. When the lamp is not turned on, connect an oscilloscope to the test point F and observe 38KHz stereo subcarrier is correctly generated or not.

4. FM AND AM TUNER ALIGNMENT

The following alignment for FM and AM tuner requires many precision measurement equipments. No alignment should be performed in the field unless the service man has those equipments and enough knowledge in solid state amplifier components, since all the units are factory aligned and not become misaligned by themselves.

4.1 AM Front End

4.1.1 Local Oscillator and Tracking Alignment

1) Set AM signal generator to 600KHz, 400Hz 30% modulation. Tune the receiver to the same frequency and adjust oscillator coil L202 until the dial pointer coincides with the 600KHz marking on the dial.

2) Set AM Signal generator to 1400KHz. Tune the receiver to the same frequency and adjust the trimming capacitor mounted on the tuning capacitor.

3) Repear procedure 1 and 2 until no further adjustment is necessary

between the low end and the high end.

4) Set the generator to 600KHz. Tune the receiver to the same frequency and adjust antenna coil L001 in the plastic case and RF coil L201 for maximum output.

5) Set the generator to 1400KHz. Tune the receiver to the same frequency and adjust each antenna trimming capacitor and RF trimming capacitor mounted on the tuning capacitor for maximum output.

6) Repeat procedure 4 and 5 until no further improvement is obtained.

Note: During tracking alignment reduce the signal generator output as necessary to avoid AGC action.

4.2 AM IF Amplifier

For aligning the AM IF-amplifier, a sweep generator with marker generator combined is necessary.

1) Connect sweep generator across pin J205 and common ground, connect an oscilloscope to test pin J527.

2) Turn each primary and secondary core of IF transformers L203, L510 and L511 for maximum and symmetrical response.

4.3 FM Front End

4.3.1 Local Oscillator Adjustment

1) Measuring instruments connection
Connect an FM signal generator to the FM antenna terminals on the back side of the set. Connect a VTVM or an oscilloscope across the speaker system terminals.

2) Set FM signal generator to 90MHz, 400Hz 100% modulation. Tune the receiver to the same frequency and adjust oscillator coil L104 until the dial pointer coincides with the 90MHz marking on the dial.

3) Set FM signal generator to 106MHz. Tune the receiver to the same frequency and adjust the trimming capacitor C119 until the dial pointer coincides with the 106MHz marking on the dial.

4) Repeat procedure 2 and 3 until no further adjustment is necessary between the low end and the high end.

4.3.2 FM Tracking Alignment

1) Set FM signal generator to provide about 5uV at 90MHz. Tune the receiver to the same frequency and turn each core of L101, L102 and L103 for maximum output.

2) Set FM signal generator to 106MHz. Tune the receiver to the

same frequency and adjust trimming capacitors C104, C110 and C112 for maximum output.

3) Repeat procedure 1 and 2 until no further improvement is obtained.

4.3.3 FM IF Amplifier

To align this IF amplifier, connect FM signal generator to the FM antenna terminals and set the generator to 98MHz, 400Hz 100% modulation with output level about 5uV. Tune the receiver to this frequency and turn each core of IF transformers, L105 and L519 for maximum output. To align the discriminator transformer L507, increase the FM signal output level to about 2KuV and connect a distortion meter across the tuner output or speaker output terminals.

1) First tune the receiver off station until only interstation noise is heard, then turn the secondary core of L507 so that the pointer of center tuning meter indicates its center.

2) Tune the receiver to 98MHz FM signals again with center tuning meter in its null position, then turn the primary core of discriminator transformer L507 so that minimum distortion is obtained.

4.3.4 FM Stereo Demodulator

A stereo multiplex and RF FM signal generator is required to make the separation adjustment on this circuit.

Perform the following adjustments in sequence.

1) Set FM signal generator to 97MHz, 2KuV output level. Tune the receiver to the same frequency, be sure the pointer of center tuning meter is at the center position, and MONO(L+R) switch is in its normal "out" position.

2) Connect oscilloscope probe to pin J526 and turn each core of L514, L512 and L513 for maximum stereo carrier wave on the CRT.

3) Turn the core of L514 again so that same stereo separation is obtained in both L and R channels.

4) Adjust a trimming resistor R024 for maximum and same stereo separation in both channels.

Note: In early units no trimming resistor is provided.

4.3.5 FM Sub-IF Amplifier Alignment

To align the sub-IF amplifier, tune the receiver to FM signals and turn each core of L508 and L509 so that the FM signal strength meter reads maximum deflection. To read the signal strength meter the antenna tuning switch must be in its normal out position.

5. POWER AMPLIFIER

5.1 Circuit Description

5.1.1 Amplifier

The signal from the tone amplifier is applied to the inverting input (pin 2) of the operational amplifier H601 through the input coupling network R601, C601 and R603. This network provides a high input impedance to the amplifier and prevents any DC from appearing at the op amp input.

The output of the op amp is divided by networks C609/R627 and C611/R631, and is applied to the base of H607 and H611. H607 and H611 provide the voltage amplification necessary to drive the driver (buffer) transistors H613 and H609. H613 and H609 are operated in a complimentary-symmetry configuration with their respective power transistors H001 and H003.

The output of H613 is applied to the base of H001, and the output of H609 is applied to H003. The combined operation of PNP transsistors H001 and NPN transistors H003 provide a push-pull output appearing at diodes H005. This output is applied to network R010 L005, and via relay L007 contact to the LOUDSPEAKER output terminals (J002).

To maintain overall amplifier stability and linearity, degenerative feedback is utilized throughout the amplifier. This feedback is also necessary to reduce distortion to within specified limits. R/C network R611, C603, and R607 condition the feedback signal for application to the non-inverting input (pin 3) of the op amp.

Except for the input, the amplifier uses direct coupling throughout. An offset voltage is applied to pin 3 of the op amp to nullify any undesirable DC output signal. The offset voltage is provided by a voltage divider consisting of R613, R617, and R615 between the plus and minus 14 volt source such that DC OFFSET ADJ. R615 may be adjusted through a plus or minus 1.3 volt range.

5.1.2 Dynamic Bias

Dynamic bias is applied to the bases of driver transistors H613 and H609. H613 and H609, in turn, determine the class of operation for the power amplifier (PA) transistors H001 and H003, thus maintaining a constant class of operation by establishing and maintaining the proper collector-to-emitter current. This dynamic bias circuit is comprised of H967, R961, and temperature sensitive diode H961, H962, H963. The circuit provides a variable base bias for driver transistors H613 and H609 that automatically maintains the proper base voltage (bias condition) with temperature change. Temperature sensitive biasing components of the dynamic bias circuit are thermally coupled through a heatsink to the PA transistors.

5.1.3 Amplifier Protection

Protection for the amplifier is provided by sensing-resistors R641

and R643 operating in conjunction with H603 and H605. When the output power transistors H001 and H003 are over-driven, and the output power exceeds an approximate 55 watts, the current increase through the power output transistors causes an increases current flow through R641 and R643. The resulting voltage drop across R641 and R643 controls the biasing of H603 and H605, resulting in the clipping of any input signal of greater amplitude than is required to cause the power output stage to deliver approximately 55 watts.

5.2 DC Balance and Bias Adjustment of The Main Amplifier

Connect a VTVM across the speaker system output terminal for the channel being tested. Set the voltage range on VTVM to the lowest scale possible, preferably 100 or 300 mV full scale deflection. First turn Bias control resistor R961 and R962 fully clockwise. Adjust DC balance control R615 until no DC voltage is obtained at the speaker terminal strip. Repeat the procedure for the other channel.

Next proceed to the Bias adjustment.

Connect the VTVM across R651 or R653 and adjust bias control resistor R961 until the VTVM reads 10mV. To adjust the other channel bias current connect the VTVM across resistor R654 or R652 and adjust bias control resistor R962 for the same voltage reading.

Note: PC board P960, on which bias control resistors R961 and R962 are located is mounted on backside of the power transistor.

5.3 Suggestions for Trouble Shooting of Power Amplifier

5.3.1 Excessive line consumption (100 watt or more).

a. Check for shorted rectifiers H006; also check C010 and C011.
b. Check for shorted transistors H613, H609, H001 and H003, or check H967. Check for open control R961, and bias diode H961--H963. Check L006 for short.

CAUTION: Because the driver and output stages are direct coupled components may fail as a direct result of an initial component failure. If a shorted transistor or zener diode is found, or control or bias diode, be sure to check the remaining driver and output components for short or open circuit before re-energizing the amplifier.

5.3.2 No Line Consumption or Zero Bias

a. Check line cord, circuit breaker, transistors H967, H001 and H003, bias diode H961---H963.
b. Check for open rectifiers H006, or open L006.

5.3.3 High D-C Voltage at Loudspeaker Terminals at all Times.

a. Check H005 for open or short.

5.3.4 No D-C Balance

a. Check H601 (op amp) and zener diodes H615 and H617.
b. Check R613, R615, and R617

6. SPEAKER PROTECTOR RELAY CIRCUIT

The speaker protector Relay circuit, mounted on PC board, P980, protects the speaker systems against any loud "POP" sound developed. This circuit is so designed that no sound is heard for the first five seconds after the power switch is turned on by the time constant of capacitor C982 and resistor R984. This circuit also protects the speaker systems against some troubles due to DC off balance between the speaker system terminals by instantly operating the relay and cutting off the speaker systems from the circuit.

7. REGULATED POWER SOURCE ALIGNMENT

The regulated power supply unit mounted on PC board P800 is dual unit. One unit consisting of transistor H801 and H803, supplies its regulated DC current to each unit, FM Front End, AM Front End, AM IF/FM IF and MPX Demodulator and differential amplifier mounted on half of PC board P700. Adjust trimming resistor R811 until the DC voltage between the J804 and ground is 12V. Any short-circuit of the DC output line may damage transistor H801. Be extremely careful not to make a short-circuit. The other unit consisting of transistor H802 and H804, furnishes its regulated output to the Tone amplifier, Phono amplifier and Auxiliary amplifier mounted on half of PC board P700. Adjust trimming resistor R812 for 27V DC output at pin J805. Be careful not to make a short-circuit. Any short circuit may damage transistor H802.

8. CENTER TUNING METER NULL ALIGNMENT

A differential amplifier consisting of four transistors (H701, H702, H703 and H704) is used to drive center tuning meter M002. The input current to the differential amplifier is obtained from the FM discriminator through resistor of R514 and antenna tuning switch S002. The null adjustment of this meter amplifier is done by adjusting trimming resistor R704 with the selector switch placed in the PHONO 1 or 2 position.

9. PHONO and tone amplifiers consist of conventional negative feed bork amplifiers and no analytical circuit description may be required.

10. TEST EQUIPMENT FOR SERVICING

Item	Manufacturer and Model No.	Use
AM Signal Generator		Signal Source for AM Alignment
Test Loop		Used with AM Signal Generator
FM Signal Generator	Less than 0.3% distortion	Signal source for FM Alignment
Audio Oscillator	Less than 0.02% residual distortion is required	Sine wave source for modulating AM or FM Signal Generator, or trouble shooting
Stereo Modulator	Less than 0.3% distortion	Modulating FM Signal Generator for Separation Alignment and trouble shooting
Oscilloscope	High Sensitivity	Wave form analysis and trouble shooting
VTVM	with RF probe	Trouble shooting
Circuit tester		Trouble shooting
Sweep Generator	For 455KHz and 10.7 MHz IF alignment	AM and FM IF alignment
8-ohm Resistors	±0.5% 50W (no inductive Resistance)	Dummy Load
Line Voltmeter	0---150V AC	Monitors line voltage
Variable Auto transformer	0 to 140V, 10amps	Adjust level of primary power to amplifier

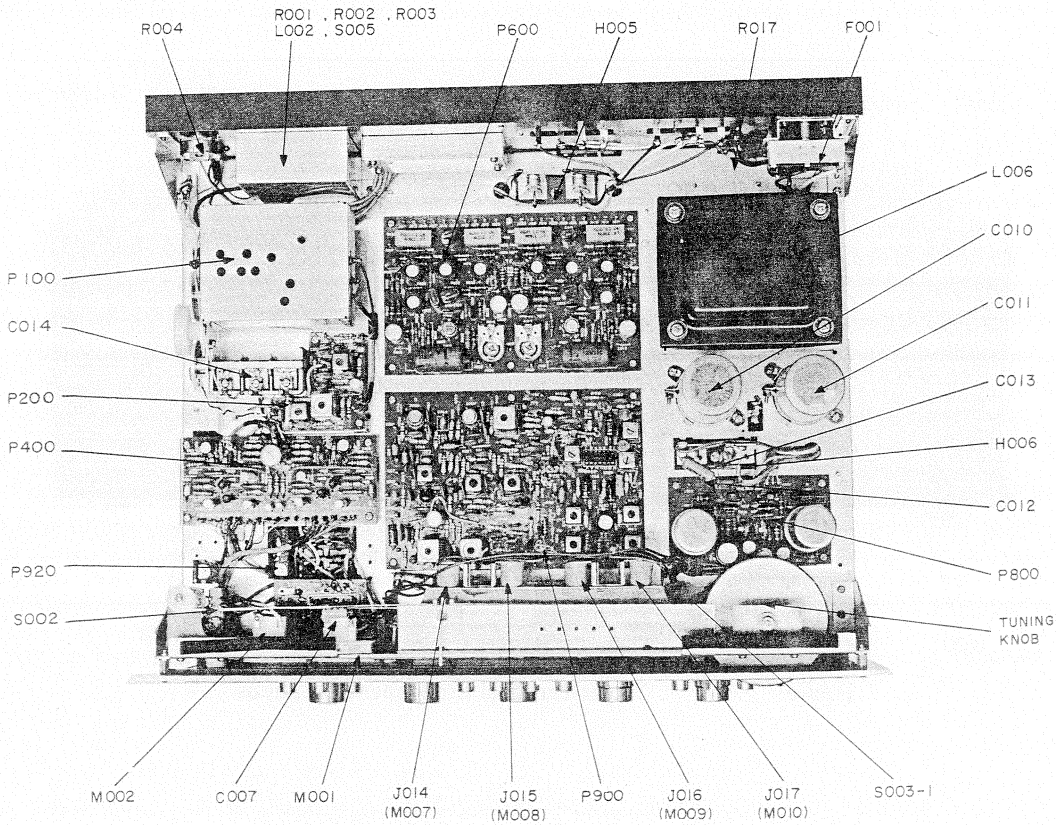


Figure 1 Main Chassis Component Locations Top View

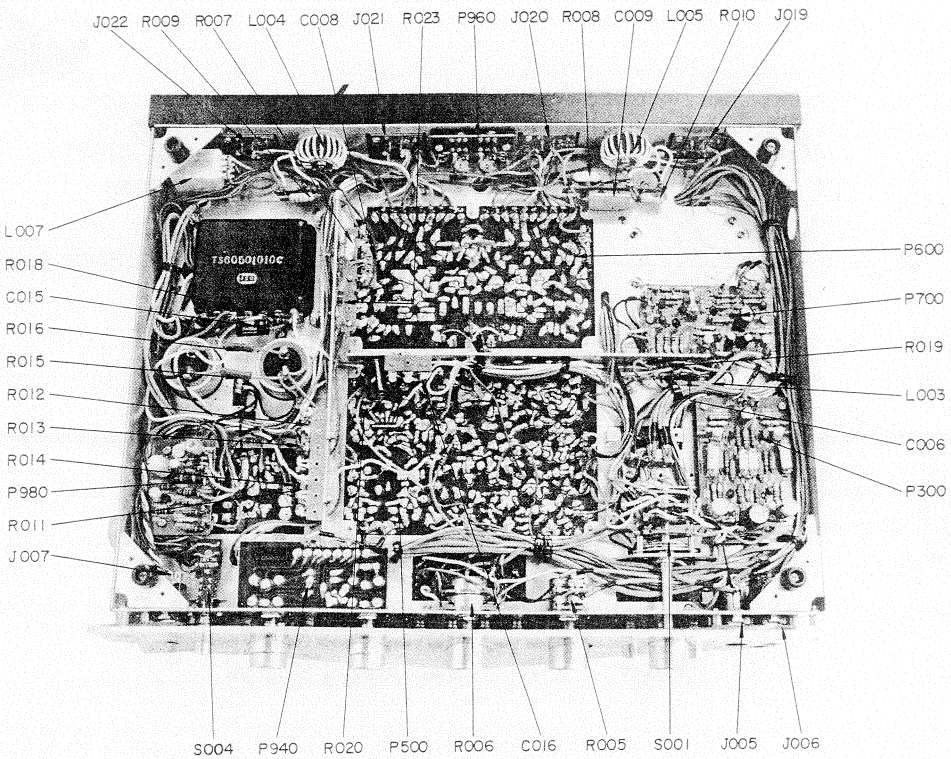


Figure 2 Main Chassis Component Locations Bottom View

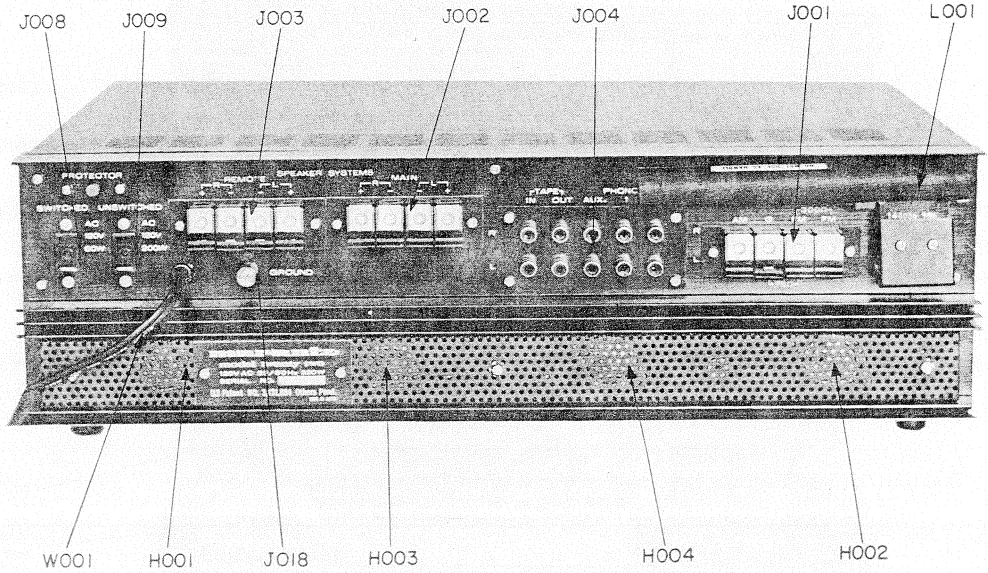


Figure 3 Rear Terminal Component Locations

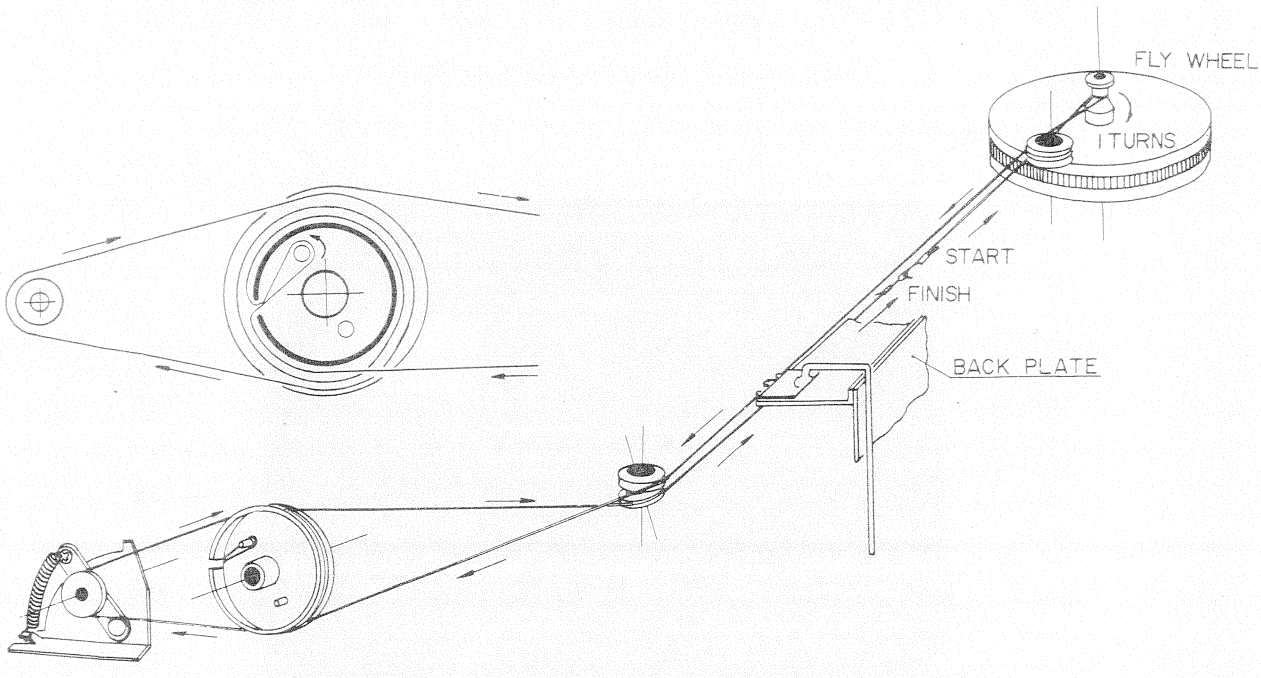


Figure 4 Dial Stringing Diagram

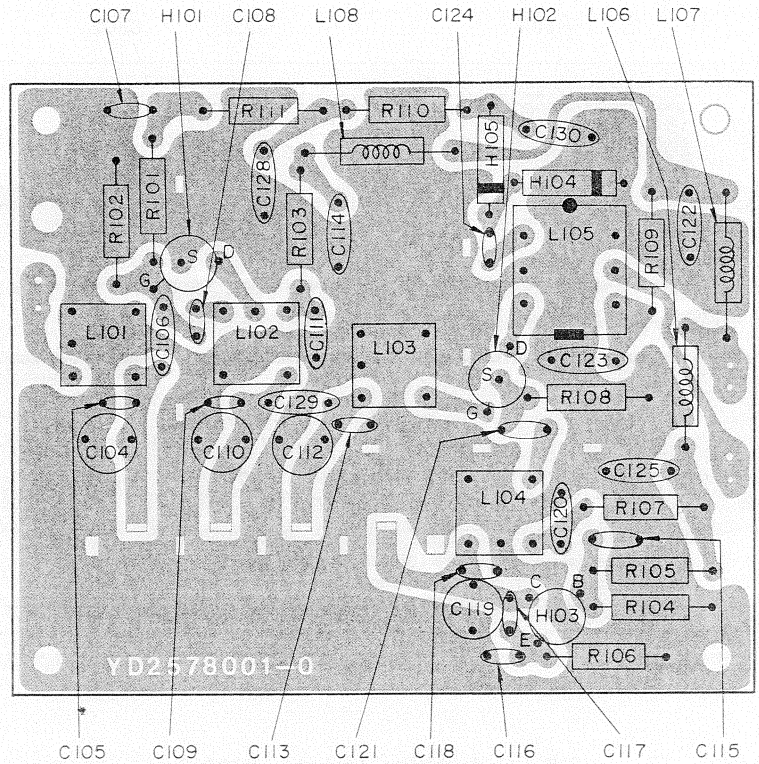


Figure 5 FM Front End Assembly P100 Component Locations

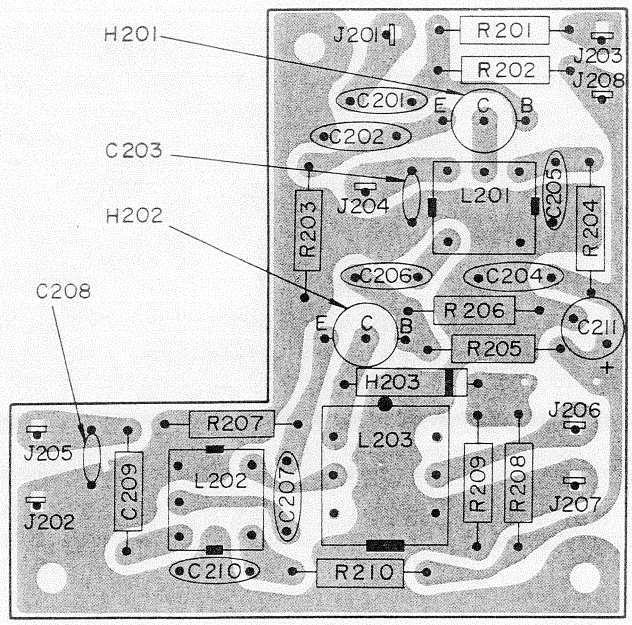


Figure 6 AM Front End Assembly P200 Component Locations

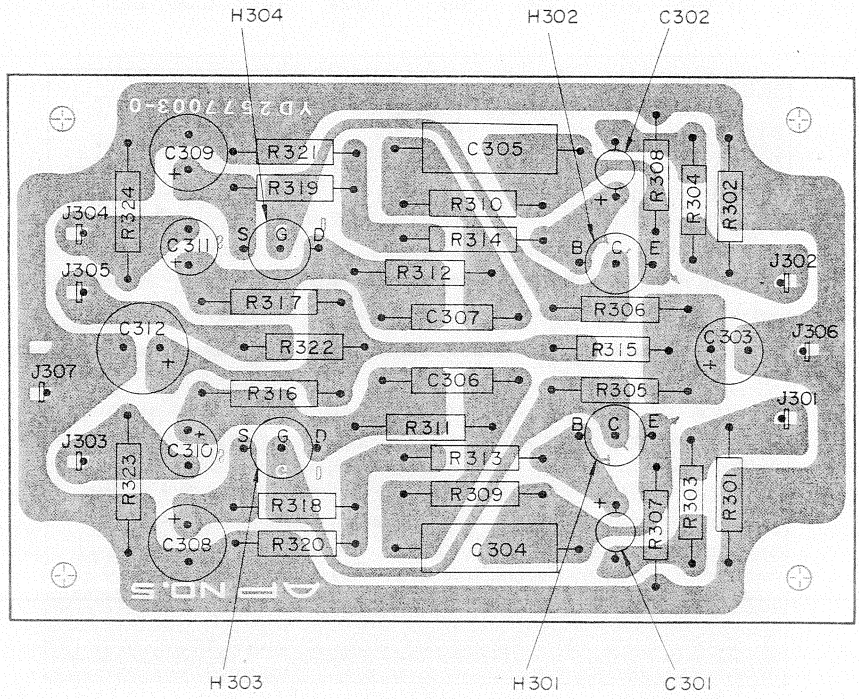


Figure 7 PHONO Amplifier Assembly P300 Component Locations

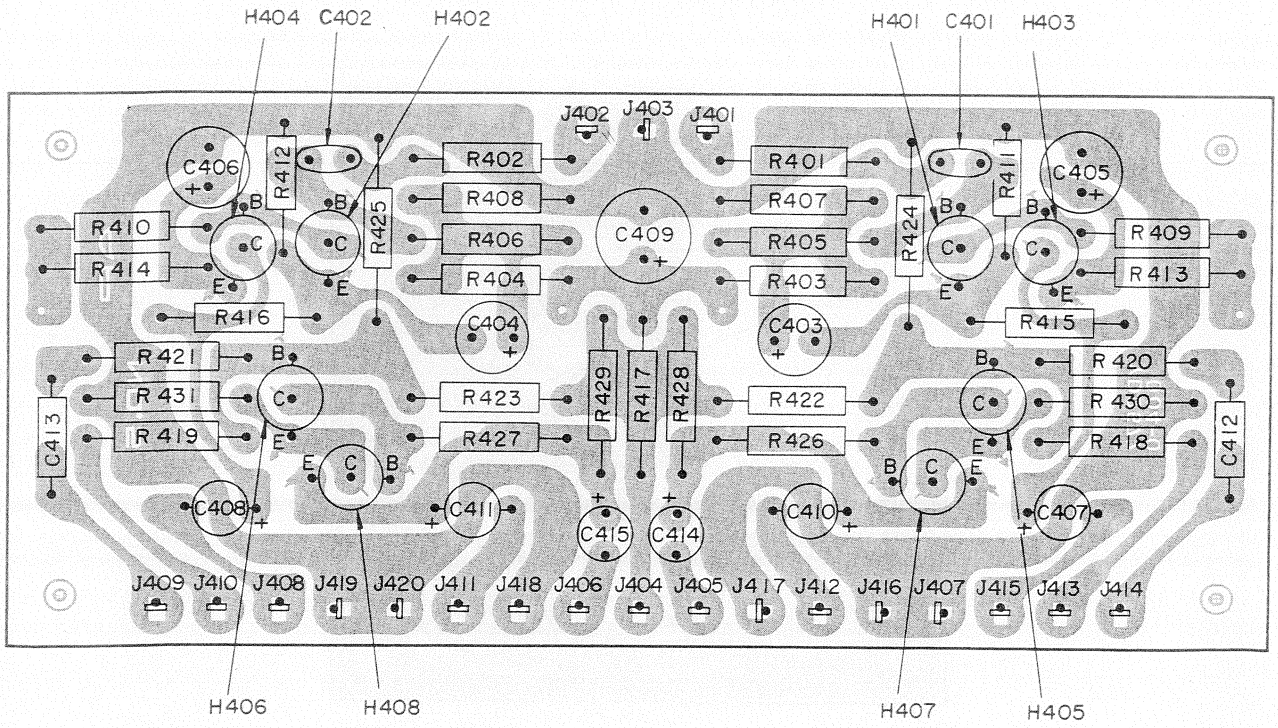


Figure 8 Tone and Pre Amplifier Assembly P400 Component Locations

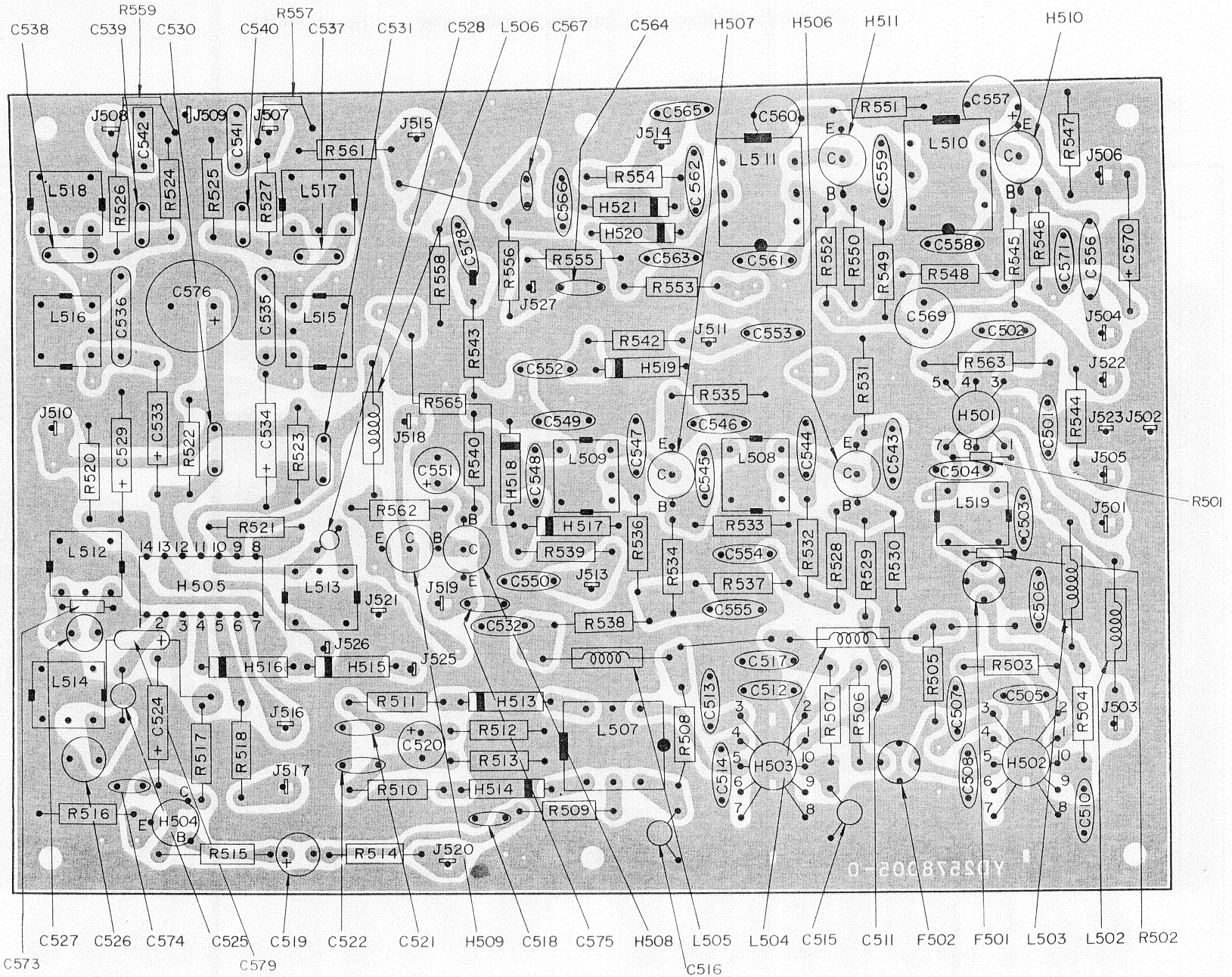


Figure 9 AM-FM IF and FM-MPX Demdulator Assembly P500 Component Locations

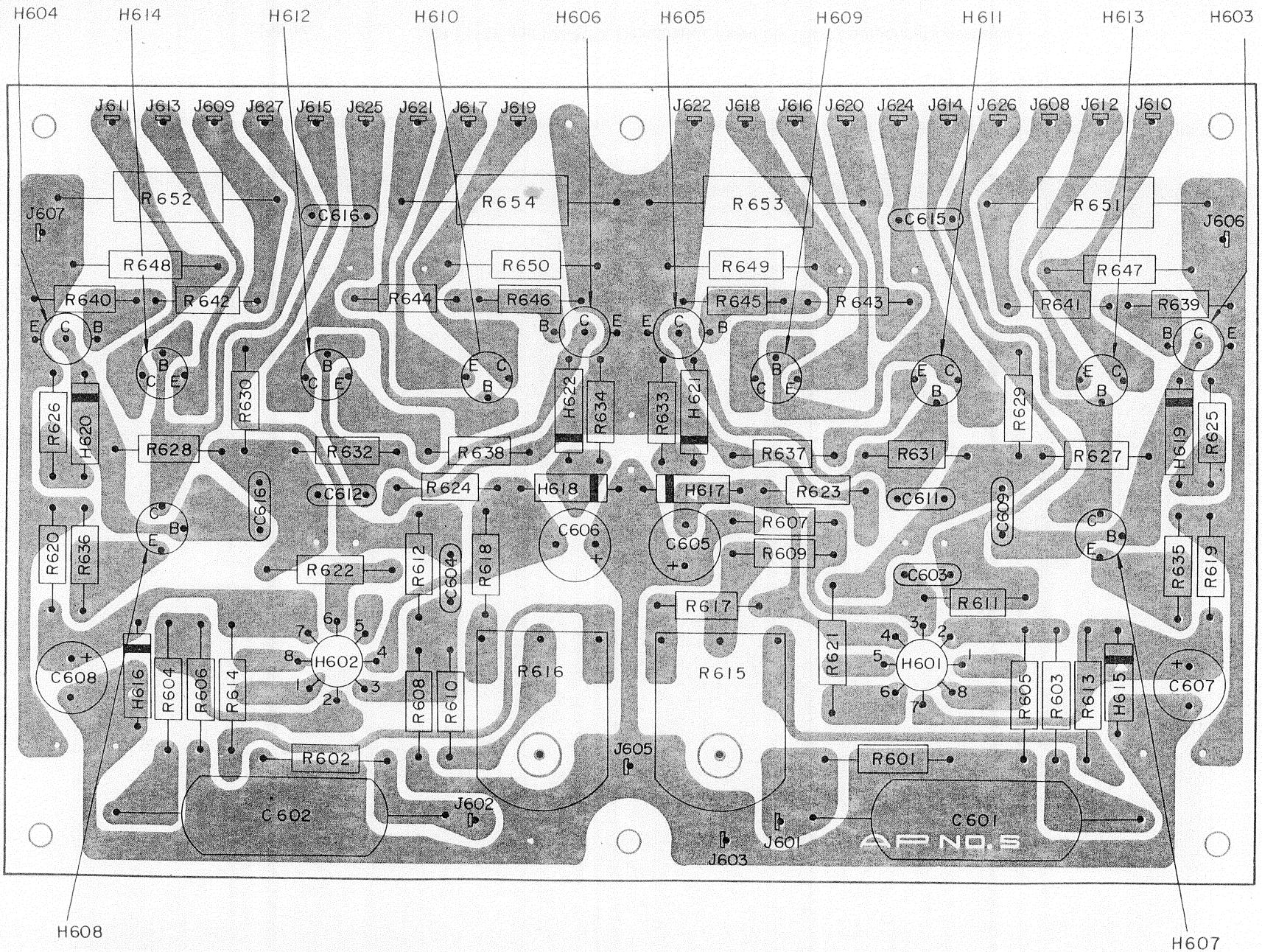


Figure 10 Main Amplifier Assembly P600 Component Locations

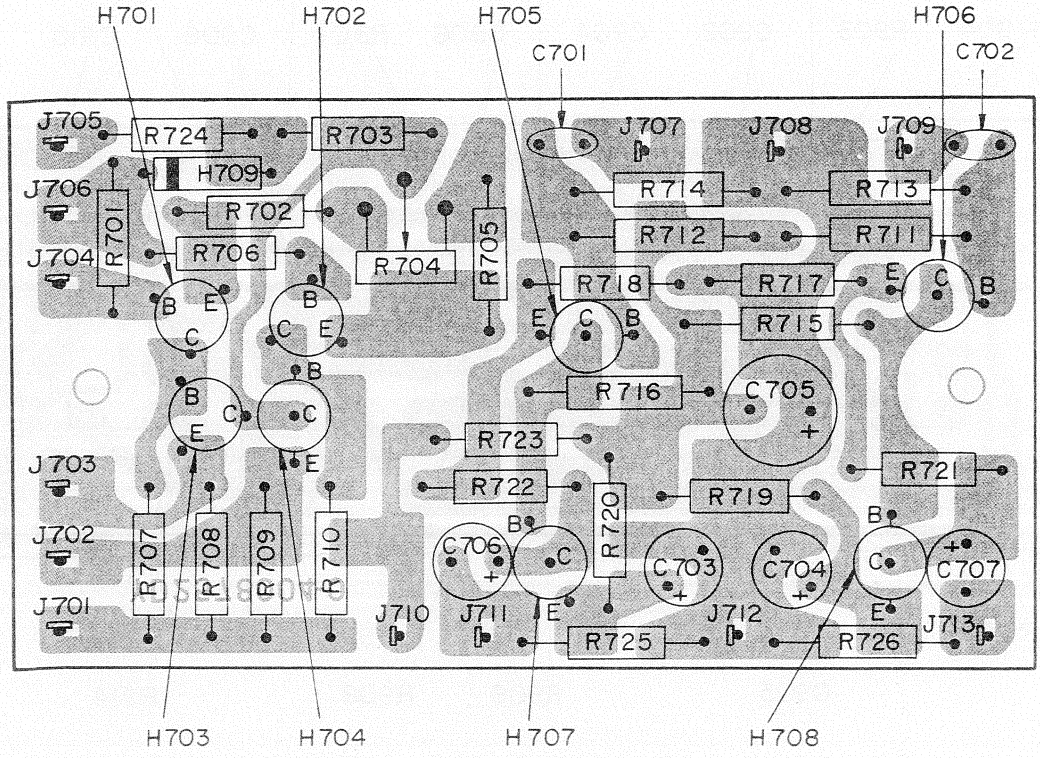


Figure 11 DC Amplifier and FM Audio Amplifier Assembly P700 Component Locations

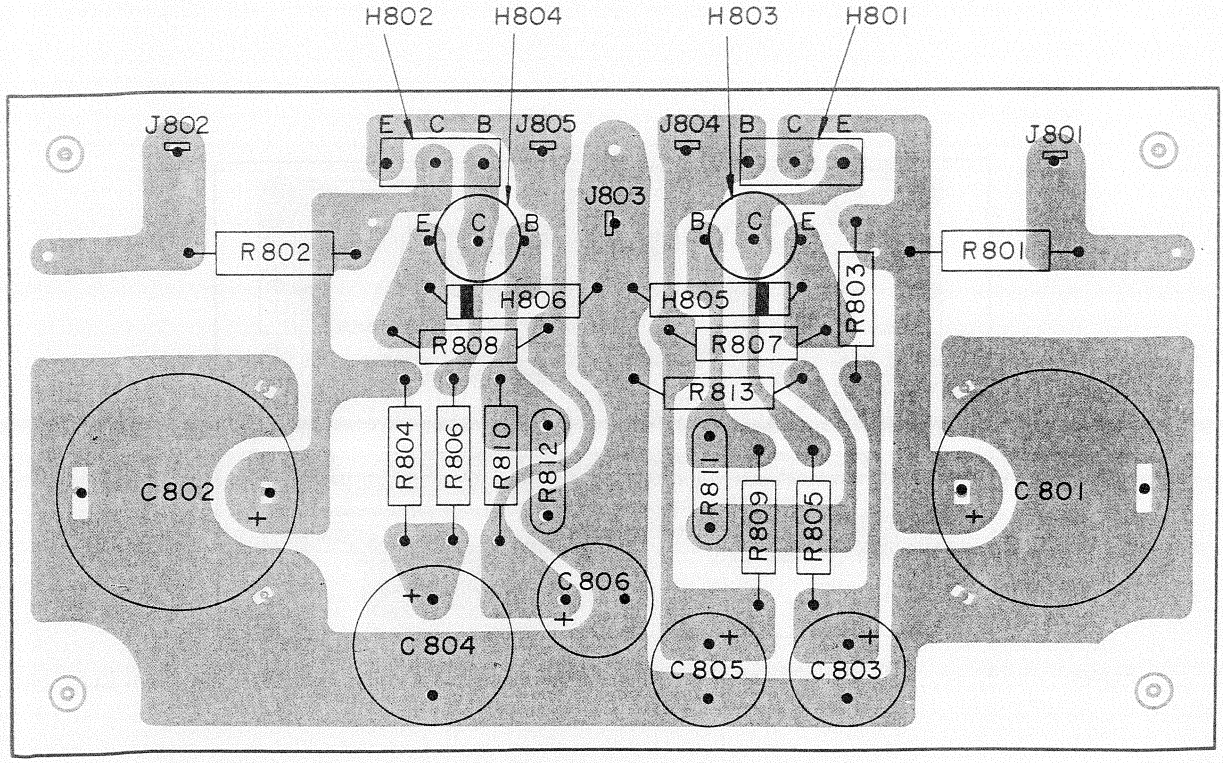


Figure 12 Regulated Power Supply Unit Assembly P800 Component Locations

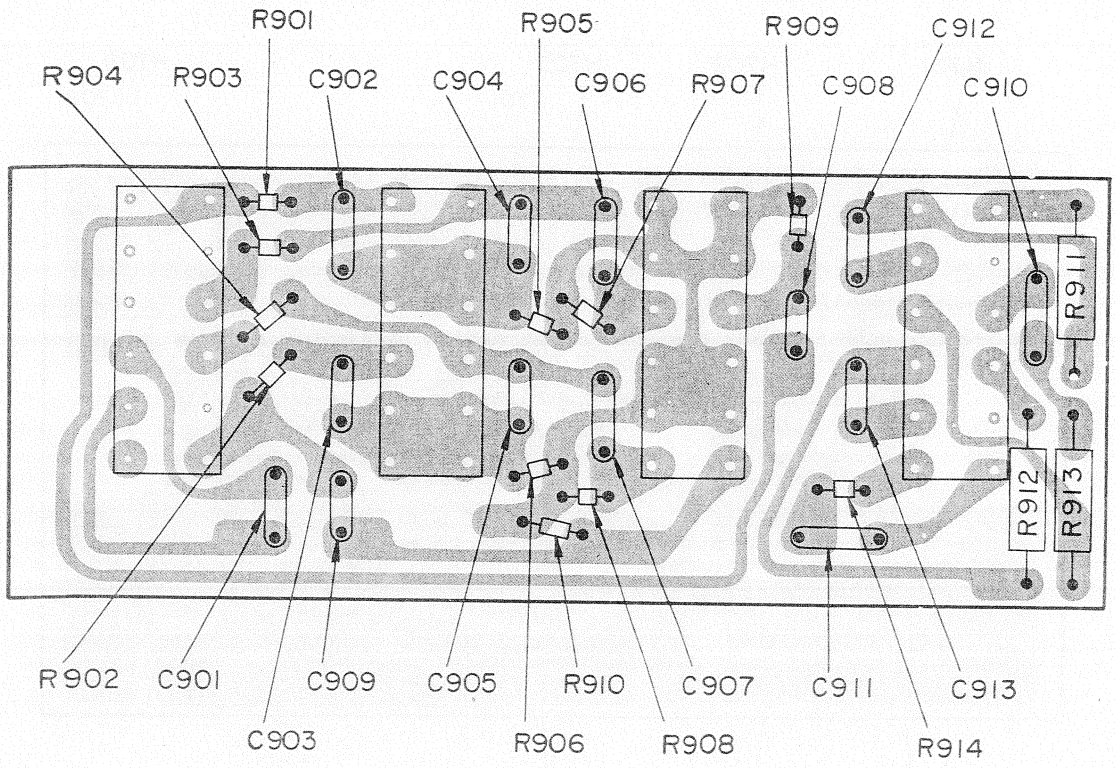


Figure 13 Hi Blend, Low Filter, Hi Filter and Loudness Switches Unit Assembly P900 Component Locations

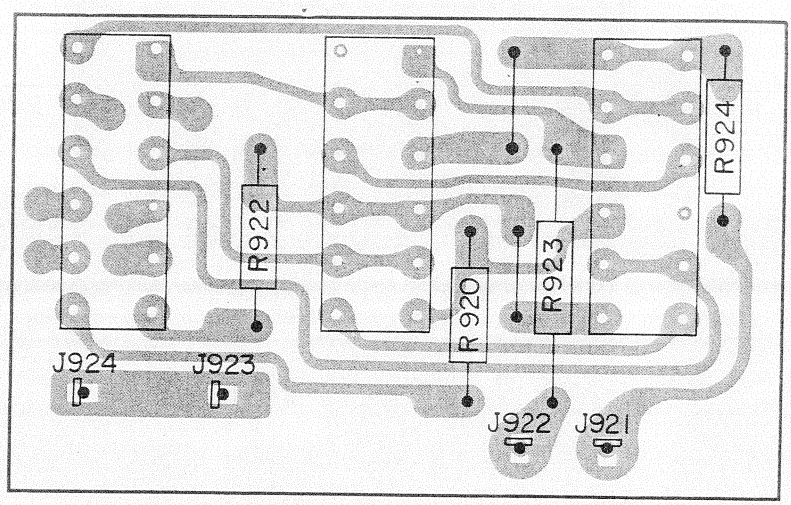


Figure 14 Tape Monitor and Mono in L.R. Switches Unit Assembly P920 Component Locations

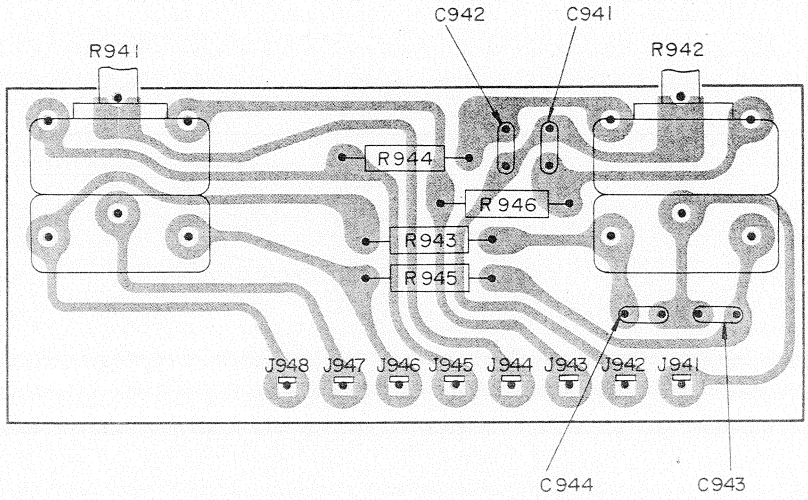


Figure 15 Tone Control Unit Assembly P940 Component Locations

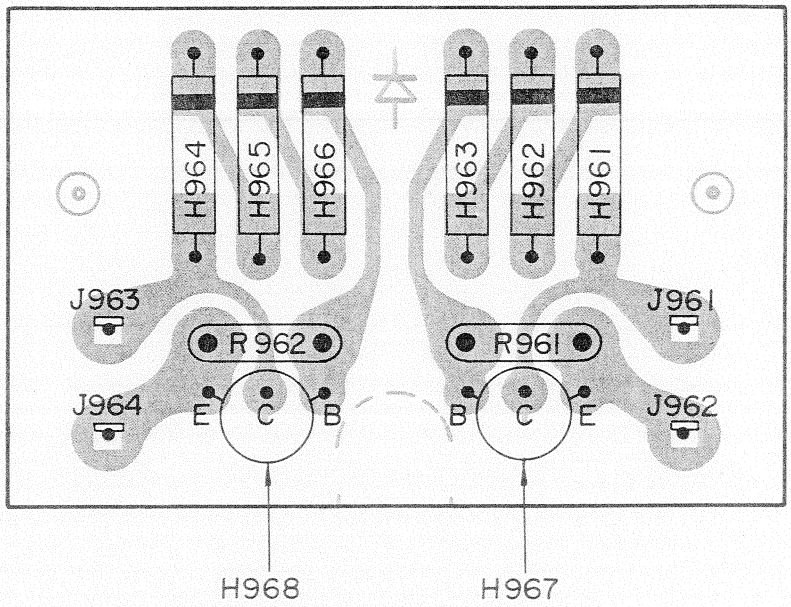


Figure 16 Temperature Compensation Unit Assembly P960 Component Locations

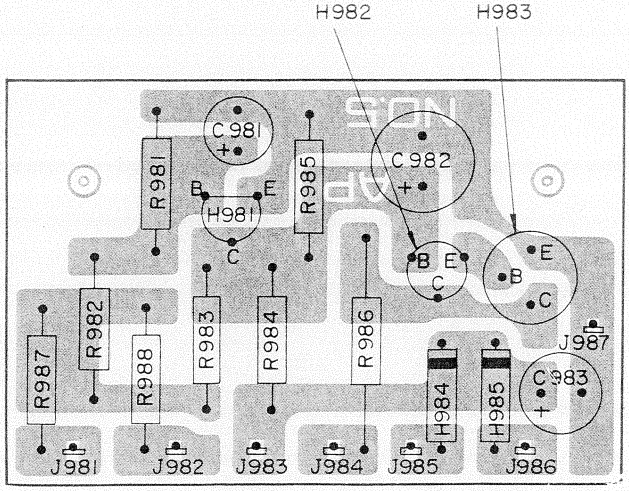
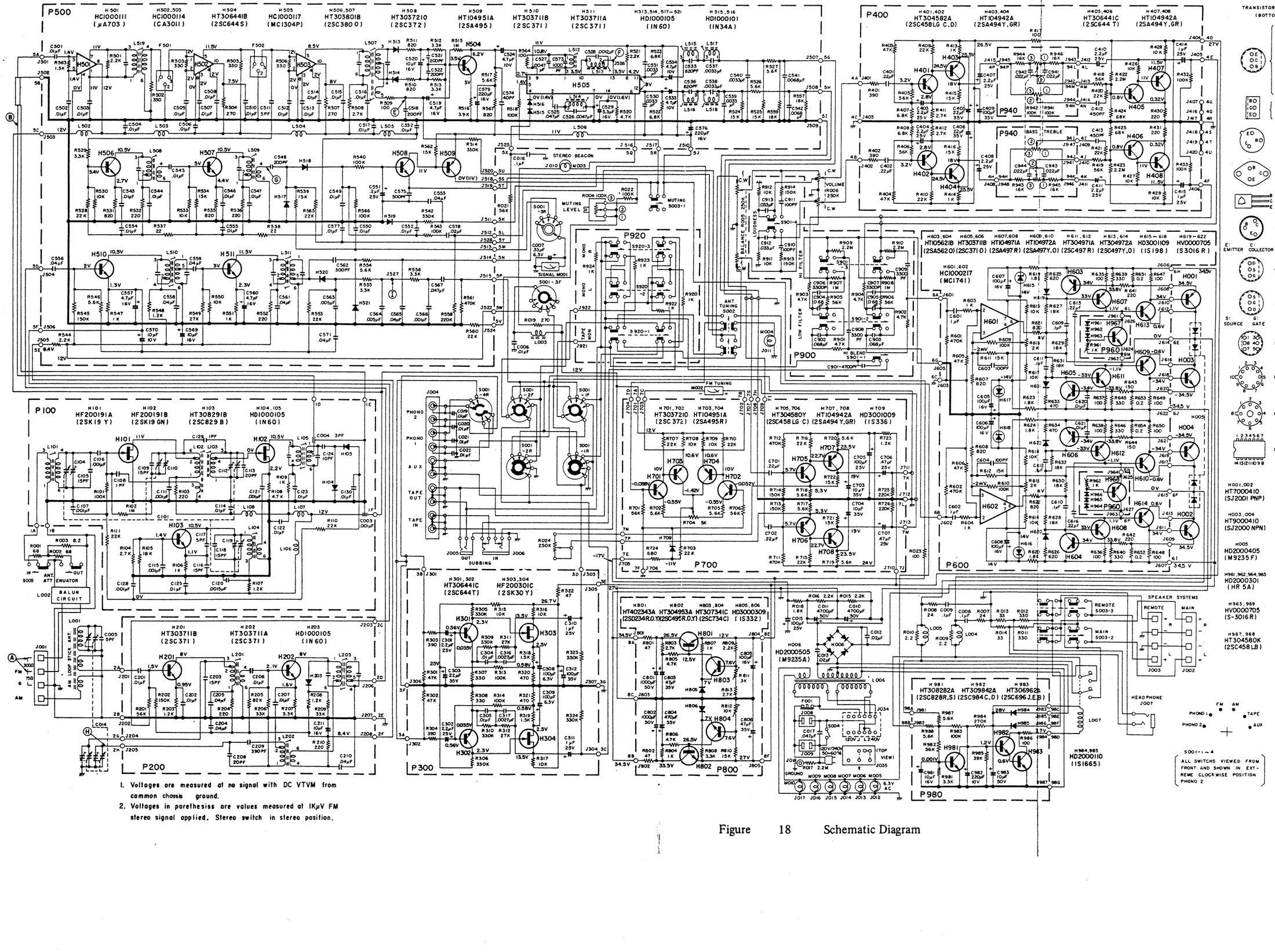


Figure 17 Speaker Protector Circuit Assembly P980 Component Locations



1. Voltages are measured at no signal with DC VTVM from common chassis ground.
2. Voltages in parethesiss are values measured at 1KμV FM stereo signal applied, Stereo switch in stereo position.

Figure 18 Schematic Diagram